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Lab 4, Milestone 1

Software Design & Preliminary Test Criteria

Software Design

Our software design will be implemented in the following user interface. Upon flashing and resetting the TIVA Launchpad, the user will select a number on the 4x4 Keypad which will indicate the wave type, then will press star. The LED will turn red when in this mode to identify that the user is in Keypad-scanning mode. Our program will treat star as a terminating key, taking in the digit pressed before star and changing from key-scanning mode to a specific waveform mode if the digit is one of the following:

- **Key 1 -** Sine Wave (variable amplitude, 83.3 Hz default frequency, variable LPF)
- **Key 2 -** Ramp Wave (variable amplitude, 62.5 Hz default frequency, variable LPF)
- **Key 3 -** Triangle Wave (variable amplitude, 83.3 Hz default frequency, variable LPF)
- **Key 4 -** Square Wave (variable amplitude, 500 Hz default frequency, no LPF)

If the digit pressed is not one of these keys, our program will reset the key input and flash the red LED to tell the user to try again. Once the user input is correct, our program will change to waveform mode, activating SW1 and SW2 as inputs and turning the LED green. SW1 is activated by default in this mode, allowing the user to alter the potentiometer value to change the amplitude of the wave from 32 mV to 8 V peak-to-peak. Pressing SW2 allows the user to alter the potentiometer value to change the frequency from 10 Hz to 10 kHz. Since the potentiometer is one-turn only, there may be noise that we plan to combat using a digital filter that averages the current and last potentiometer value for a smoother output.

We also plan to control the low pass filter using adaptive controls that will vary the LPF value with the frequency to achieve a smoother output. Since we do not want the square wave output to be smooth, we will turn off the low pass filter for the Square Wave. In addition, we plan on possibly widening the dynamic range of the frequency after testing for feasibility.

The advantage of this specific design is that once the wave is selected, the user can change the amplitude and frequency values in real-time, seeing the waveform output as these values change.

We plan on dividing the work for this project by each user-input. In other words, we mean to distribute the work into three: Keypad input, SW1 input, and SW2 input. Although it is subject to change, Austin, Adrian, and Carol will each be in charge of these three sections, respectively.

Preliminary Test Criteria

Once our program is created, we plan to prove it functions correctly with the following test cases:

Test Case I

Screenshots of Logic Analyzer in Keyscanning mode, confirming that keypresses of digits 1 through 4 are being properly read. Screenshots of a re-enter after a false digit press.

Test Case II

Screenshots of all waveforms at 8 V peak-to-peak amplitude, default frequencies, default variable LPF values, and 0 V DC offset.

Test Case III

Screenshots of all waveforms at 4 V peak-to-peak amplitude, 10 kHz frequency, default variable LPF values, and 0 V DC offset.

Test Case IV

Screenshots of all waveforms at 1 V peak-to-peak amplitude, 1 kHz frequency, default variable LPF values, and 0 V DC offset.

Test Case V

Screenshots of all waveforms at 32 mV peak-to-peak amplitude, 10 Hz frequency, default variable LPF values, and 0 V DC offset.

Although the test cases we have described above should be enough to test all waveform types, frequencies, amplitudes, and any other options, they are subject to change until feasibility is confirmed. We will also need to be wary of how fast our code runs such that we implement the Systick clock correctly. Additionally, each waveform type will have a different sample rate since the program will generate square waveforms from 2 samples, ramp waveforms from 16 samples, and sine as well as triangle waveforms from 12 samples.